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Installation of eArc PV Panels on TPO Roofs Mounted Using Aluminum C-Channel Glued By Tonsan 1527 & PS1/PT2 Adhesives Engineering Certificate

For: Sunman Energy

Level 9, 153 Walker Street
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NSW , 2060

Job No.: 12040

Date: 20/02/2023

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Report Title		Installation of eArc PV Panels on TPO Roof Mounted Using Aluminum C-Channel Glued By Tonsan 1527 & PS1/PT2 Adhesives Engineering Certificate				
Document ID		12040 D Rev1/HS		**Job No.**	12040	
File Path		G:\Shared drives\12000\12000 - 12999\12040\03 CERTIFICATION				
Client		Sunman Energy		**Client Contact**	Thomas Bell	
Rev	**Date**	**Revision Details**	**Prepared By**	**Author**	**Verifier**	**Approver**
0	16/01/23	Prelim. Issue	HS	HS		
1	02/02/23	Construction Issue	HS	HS	JG	LvS
2	20/02/23	Adding 6060-T5 Aluminum Alloy	HS	HS	LvS	LvS
Current Revision		2				

Approval			
Author Signature		Approver Signature	
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Our Ref: 12040 D Rev2/HS

20 February 2023

Sunman Energy

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Installation of eArc PV Panels on TPO Roofs Mounted Using Aluminum C-Channel Glued By Tonsan 1527 & PS1/PT2 Adhesives Engineering Certificate

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of eArc PV System installation on TPO roofs mounted using **aluminum c-channel glued by Tonsan 1527 & PS1/PT2** adhesives within Australia. The assessment has been completed based on system information and adhesive test reports provided by Sunman Energy.

For building dimensions definition, please see **Figure 1**.
For roof zones definition, please see **Figure 2**.
For recommended glue/adhesive lines & aluminum channel pattern, please refer to **Figure 3a & 3b**.
For aluminum channel section details, please refer to **Figure 4.**
For fixings requirements, please refer to **Appendix 1 & 2.**

We find the installation of eArc PV Panels on TPO Roofs to be structurally adequate and compliant with all relevant Australian standards listed below for the proposed solar installation, provided the conditions listed within this certificate are adhered to:

- Loading to:
  - AS/NZS1170.0:2002 – Structural design actions, Part 0: General principles;
  - AS/NZS1170.1:2002 (R2016) – Structural design actions, Part 1: Permanent, imposed and other actions;
  - AS/NZS1170.2:2021 – Structural design actions, Part 2: Wind actions;
- Site details:
  - Wind region — **A(0-5), B(1-2), C & D**
  - Wind terrain category — **2 & 3**
  - Wind average recurrence interval — **200 years**
- Building details:
  - Maximum average building height — **20 m**
  - Building aspect ratio — **eArc panels attached to enclosed building with aspect ratios h/d ≤0.5 and h/b ≤0.5, see Figure 1**
  - Aerodynamic shape factor (Cfig) — **-0.9 with different local pressure factors (Kl) obtained from Table 5.3(A) & Table 5.6 of AS/NZS1170.2:2021**

- Aluminum c-channel details:
  - Channel size **C20x20x1.6, see Figure 4**
  - Alloy type **6063-T5/T6 or 6060-T5**
- Refer to **Appendix 1** for fixing requirements between aluminum channel & TPO roof membrane using **PS1/PT2** adhesives
- Refer to **Appendix 2** for fixing requirements between PV panel & aluminum channel using **Tonsan 1527 silicon** adhesive
- eArc PV panels to be installed flushed to roof surface
- Tonsan 1527 & PS1/PT2 adhesives to be applied in accordance with the adhesives technical data sheet
- Installation of eArc PV panels to be done in accordance with the Sunman's installation manual

NOTES:

- **The installation eArc PV Panels is assessed based on the capacity of the adhesive and the aluminum channel but not the TPO membrane, connection between TPO and substructure, roof structure itself and PV panel.**
- **The tensile strength of PS1/PT2 adhesives is obtained from test report no: BG-2207003-1, dated 10 August 2022 by Testing Center Of Sunman (Zhenjiang) Co. Ltd. The tests were carried out on the samples with a thickness of 2.5mm±0.5mm for PS1 and 0.8mm±0.1mm for PT2, all tests were carried out at room temperature. It is assumed that PS1/PT2 adhesives will be applied with similar conditions on site.**
- **The tensile strength of Tonsan 1527 is obtained from ARL report no: MWMAL-101-004-LT draft, dated 16 June 2020 & Tonsan 1527 Technical Data Sheet, dated December 2013. The tests were carried out on the samples with a thickness of 0.5mm at room temperature. It is assumed that Tonsan 1527 will be applied with similar conditions on site.**
- **If any of the above conditions cannot be met, the structural engineer must be notified immediately.**

Construction is to be carried out strictly in accordance with the instruction manual. This work was designed by **Humam Sami** in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles. Should you need to clarify anything please contact the designer. This certificate is only valid till 20/02/2025. Gamcorp should be contacted for future validation. Contact Gamcorp for customised system or if the site conditions are not covered by this certificate.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd

L. Van Spaandonk

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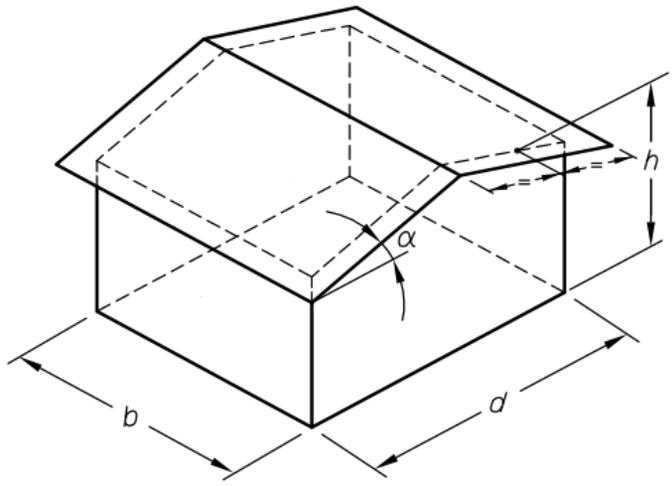

Figure 1 - Building Dimensions Definition

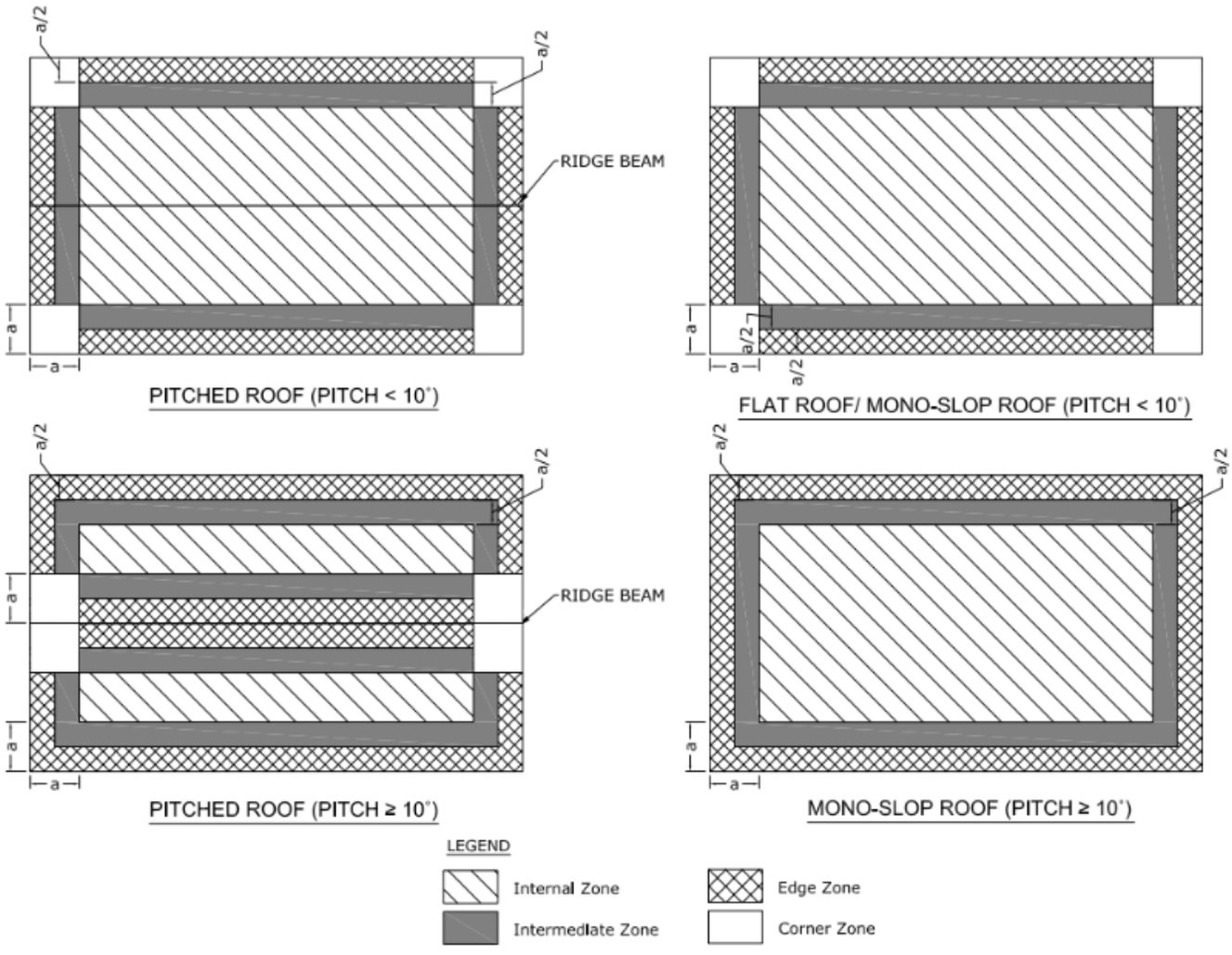

Figure 2 - Roof Zones Definition

In Figure 2, the value of dimension "a" is the minimum of 0.2b or 0.2d, if (h/b) or (h/d) ≥ 0.2; or 2h if both (h/b) and (h/d) < 0.2 (b & d are building dimensions and h is average roof height, see Figure 1)

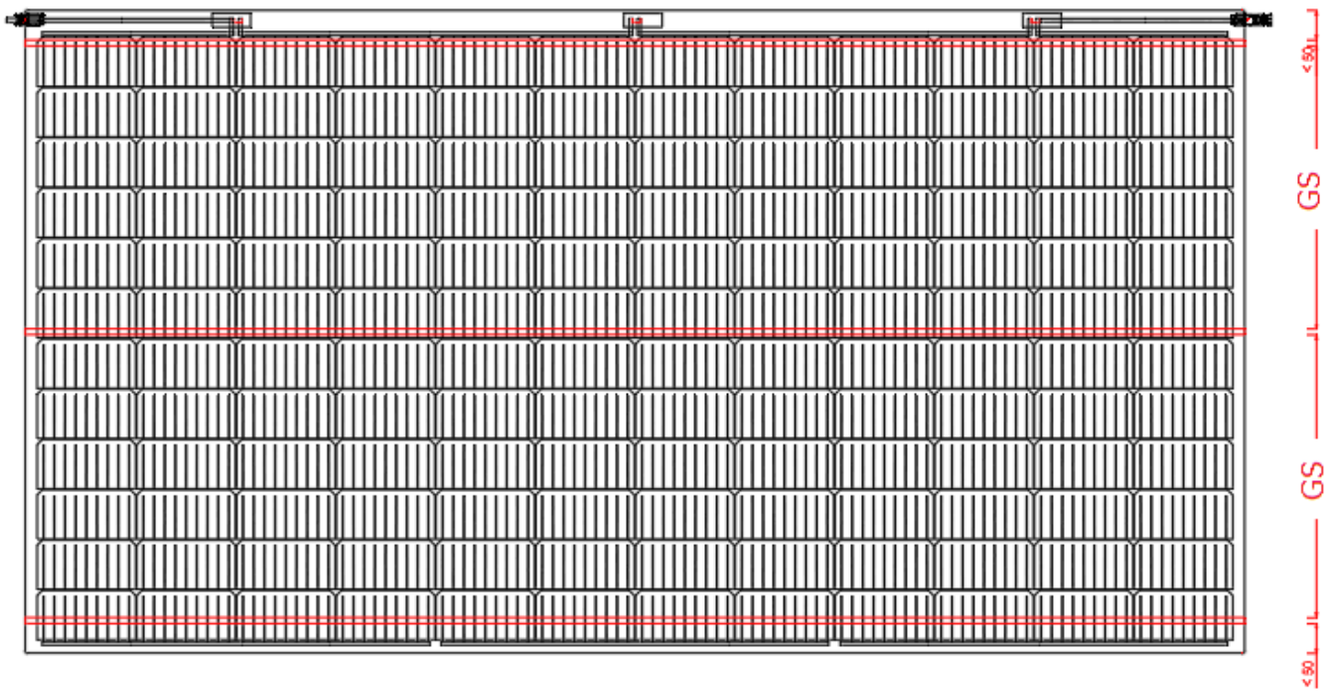

Figure 3a - Recommended Glue/Adhesive Lines & Aluminum Channel Pattern - Portrait Installation
Note: glue bonding lines shall be distributed as evenly as possible across the width of the panel
GS stands for glue/adhesive lines spacings. See **Appendix 1 & 2**

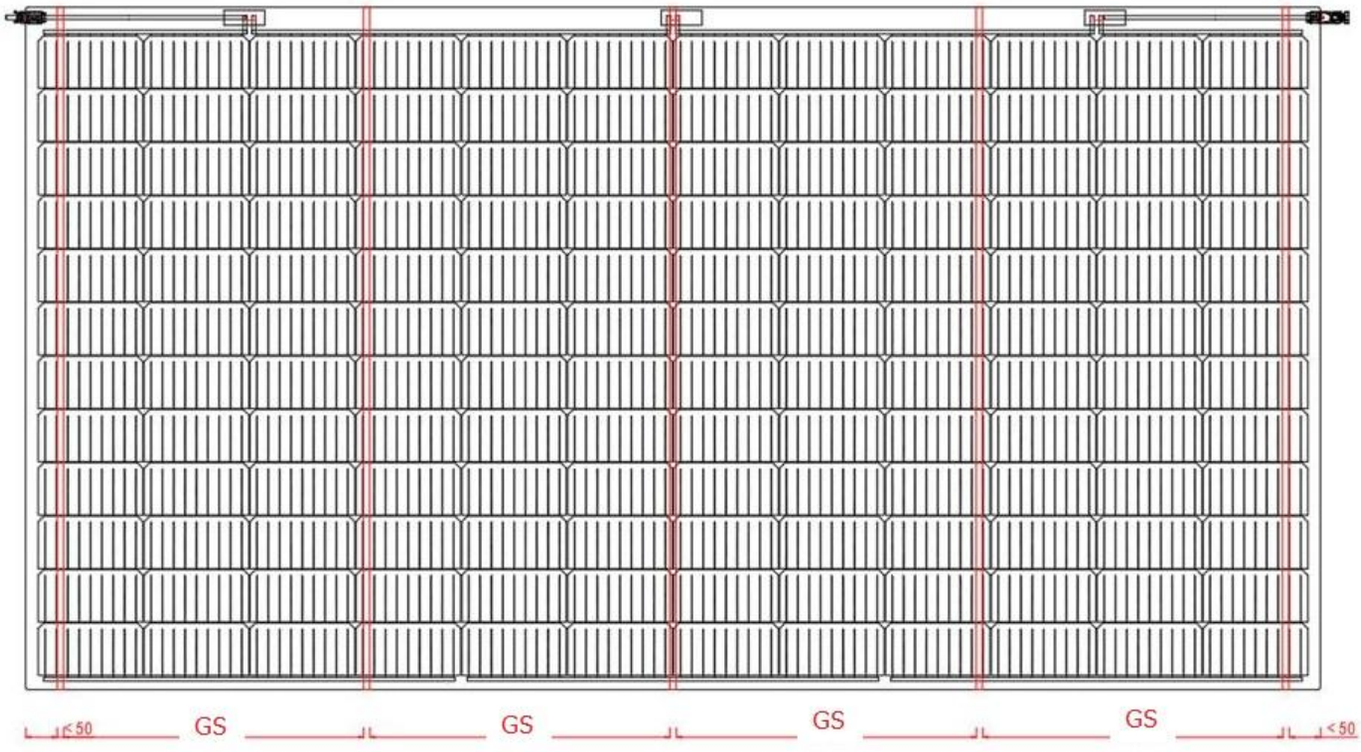

Figure 3b - Recommended Glue/Adhesive Lines & Aluminum Channel Pattern - Landscape Installation
Note: glue bonding lines shall be distributed as evenly as possible across the length of the panel
GS stands for glue/adhesive lines spacings. See **Appendix 1 & 2**

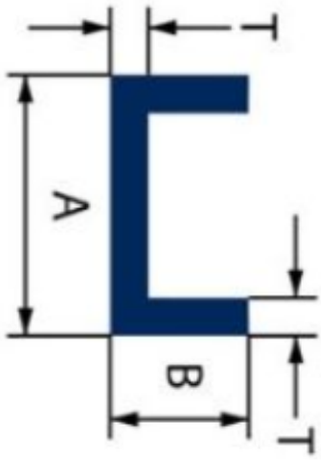

Figure 4 - Aluminum Channel Section Details
Note: A=20mm, B=20mm & T=1.6mm
Glue line should be applied on the flanges as closely as practically possible to the channel web

APPENDIX 1 - Fixing Requirements Between Aluminum Channel & TPO Roof Membrane Using PS1/PT2 Adhesives

Wind Region	Fixing Req.	Building Height – h (m)															
		h≤5				5<h≤10				10<h≤15				15<h≤20			
		Int*	Intm*	Edge	Corner	Int*	Intm*	Edge	Corner	Int*	Intm*	Edge	Corner	Int*	Intm*	Edge	Corner
A	GW*	12	18	20	20	14	20	20	20	16	20	20	20	17	20	20	20
	GS*	500	500	430	285	500	480	360	240	500	435	320	215	500	400	300	200
	PO*	50															
B1	GW*	16	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	GS*	500	440	330	220	500	360	270	180	495	330	245	165	460	310	230	110
	PO*	50															
B2	GW*	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	GS*	500	355	265	175	440	295	220	145	400	265	200	130	380	255	190	125
	PO*	50															
C	GW*	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	GS*	390	260	195	130	320	215	160	105	290	195	145	95	275	185	135	90
	PO*	50															
D	GW*	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	GS*	280	185	140	90	230	155	115	75	210	140	105	70	195	130	95	65
	PO*	50															

Notes:

- **GW: stands for glue/adhesive width in (mm)**
- **GS: stands for glue/adhesive spacing in (mm)**
- **PO: stands for panel overhang in (mm)**
- **Int: stands for internal roof zone**
- **Intm: stands for intermediate roof zone**

APPENDIX 2 - Fixing Requirements Between PV Panel & Aluminum Channel Using Tonsan 1527 Silicon Adhesive

Wind Region	Fixing Req.	Building Height – h (m)															
		h≤5				5<h≤10				10<h≤15				15<h≤20			
		Int*	Intm*	Edge	Corner	Int*	Intm*	Edge	Corner	Int*	Intm*	Edge	Corner	Int*	Intm*	Edge	Corner
A	GW*	8															
	GS*	See Appendix 1															
	PO*	50															
B1	GW*	8															
	GS*	See Appendix 1															
	PO*	50															
B2	GW*	8															
	GS*	See Appendix 1															
	PO*	50															
C	GW*	10															
	GS*	See Appendix 1															
	PO*	50															
D	GW*	12															
	GS*	See Appendix 1															
	PO*	50															

Notes:
- **GW: stands for glue/adhesive width in (mm)**
- **GS: stands for glue/adhesive spacing in (mm)**
- **PO: stands for panel overhang in (mm)**
- **Int: stands for internal roof zone**
- **Intm: stands for intermediate roof zone**